

The Approach to Segmentation

Segmentation Plan

NASA, along with its Decommissioning Team developed a segmentation plan that sequenced the work in exacting detail so that all team members will understand how the work will be accomplished for every item to be removed.



ALARA ANALYSIS

With safety for workers as the primary goal, NASA adheres to the ALARA principles (minimizing radiation dose to As Low As Reasonably Achievable).

Dose estimates (the potential radiation exposure) were calculated based on the time it would take a specified number of workers to complete each segmentation task. The ALARA analysis, backed by information gained from two reactor vessel entry investigations and interviews with NASA retirees (the last to see the reactor open nearly 30 years ago) confirmed the need for modifications to the segmentation plan to minimize the potential radiation dose to segmentation workers.



Worker operates remote tools during Reactor tank entry.

Reactor Tank Entries

NASA conducted two reactor tank investigations to more closely examine reactor internals and plan for their removal.

- 1 In November 2002, the reactor tank was opened for the first time in nearly 30 years, providing NASA with critical information about the actual location of the internal components and their current physical condition.
- 2 NASA conducted a follow-up reactor tank entry in March 2003 primarily to inspect two reactor internal components - the horizontal beam tubes and the beryllium plates.

Segmentation Phases

The segmentation plan is divided into distinct phases of operation. A detailed scope of work, safety reviews, and radiation dose estimates were developed for each phase.

PHASE 0
Equipment set up & testing

PHASE 1
Remove horizontal beam tubes

PHASE 1A
Remove reactor internals above the core

PHASE 2
Remove internals at the core

PHASE 3
Remove internals below the core

PHASE 4
Remove reactor vessel

PHASE 5
Clean up & demobilization

Segmentation Plan Refined

Emphasis was placed on the three important principles of radiation safety - time, distance and shielding - as ways to keep worker exposure levels as low as reasonably achievable. Modifications include:

TIME

- ▶ Limit the number of people in the radioactive environment.
- ▶ Limit the time workers spend in a radioactive environment.
- ▶ Minimize the number of times a piece is handled.

DISTANCE

- ▶ Perform work remotely using modified tools equipped with long, articulated handles (bent to reach around shielding, keeping workers out of the radiation field).
- ▶ Cameras placed at the actual scene allow workers to operate equipment remotely by watching TV monitors.

SHIELDING

- ▶ The three metal shrapnel shields at the reactor opening were modified and put back in place to provide additional shielding. A large hole was cut in the shields for putting tools down into the reactor and pulling pieces out.
- ▶ Portable steel and lead "shadow shields" protect crane operators and others while pieces with a significant radiation field are being transferred to a waste liner.
- ▶ A "dedicated cask" houses the waste liner as it is being filled on the Cask Transfer System. The thick metal cask provides additional shielding from the liner contents to workers inside the containment vessel.

Individual ALARA reviews are being conducted as each segmentation phase proceeds. It is expected that dose estimates will continually decrease as the major dose sources are removed.